CLAIMS

What is claimed is:

1. An objective lens, comprising:

a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relatively near-axis region from an optical axis of the objective lens;

a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion;

a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion; and

a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the first transmitting portion.

2. The objective lens of claim 1, wherein a ratio of a diameter of the second transmitting portion to an outer diameter of the incident beam on the first reflecting portion is 0.5 or less, reducing side lobe components of a light spot formed through the second transmitting portion.

3. The objective lens of claim 2, wherein at least one of the first and second reflecting portions further comprise a path difference generating portion generating a separate optical path for at least a portion of the incident beam, reducing the side lobe components of the light spot formed through the second transmitting portion by a difference in paths of a portion of the incident beam on the path difference generating portion and the remainder of the incident beam.

4. The objective lens of claim 3, wherein the path difference generating portion projects from the concave curvature of the second reflecting portion.

5. The objective lens of claim 3, wherein the path difference generating portion recesses into the concave curvature of the second reflecting portion.

6. The objective lens of claim 3, wherein the path difference generating portion is formed in the first reflecting portion.

7. The objective lens of claim 1, wherein at least one of the first and second reflecting portions further comprise a path difference generating portion generating a separate optical path for at least a portion of the incident beam, reducing the side lobe components of the light spot formed through the second transmitting portion by a difference in paths of a portion of the incident beam on the path difference generating portion and the remainder of the incident beam.

8. The objective lens of claim 7, wherein the path difference generating portion projects from the concave curvature of the second reflecting portion.

9. The objective lens of claim 7, wherein the path difference generating portion recesses into the concave curvature of the second reflecting portion.

10. The objective lens of claim 7, wherein the path difference generating portion is formed in the first reflecting portion.

11. The objective lens of claim 1, wherein the first transmitting portion has curvature with a negative power.

12. The objective lens of claim 1, wherein a maximum angle, α, between the optical axis and an outermost ray of the incident beam passed through the second transmitting portion after passing through the first transmitting portion and reflecting on the first and second reflecting portions, satisfies the following condition in the air

$\alpha \geq 36^{\circ}$.

13. The objective lens of claim 1, wherein the first transmitting portion has curvature with a negative power.

14. An optical pickup, comprising:

a light source emitting a laser beam;

an optical path changing unit altering a traveling path of an incident beam;

an objective lens, disposed on an optical path between the optical path changing unit and an optical disk, focusing the incident beam from the light source to form a light spot on the optical disk; and

a photodetector receiving the beam reflected from the optical disk and passed through the objective lens and the optical path changing unit,

wherein the objective lens comprises

a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relatively near-axis region from an optical axis of the objective lens;

a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion;

a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion; and

a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the first transmitting portion.

15. The optical pickup of claim 14, wherein a ratio of a diameter of the second transmitting portion to an outer diameter of the incident beam on the first reflecting portion

is 0.5 or less, reducing side lobe components of a light spot formed through the second transmitting portion.

16. The optical pickup of claim 15, wherein at least one of the first and second reflecting portions further comprise a path difference generating portion generating a separate optical path for at least a portion of the incident beam, reducing the side lobe components of the light spot formed through the second transmitting portion by a difference in paths of a portion of the incident beam on the path difference generating portion and the remainder of the incident beam.

17. The optical pickup of claim 16, wherein the path difference generating portion projects from the concave curvature of the second reflecting portion.

18. The optical pickup of claim 16, wherein the path difference generating portion recesses into the concave curvature of the second reflecting portion.

19. The optical pickup of claim 16, wherein the path difference generating portion is formed in the first reflecting portion.

20. The optical pickup of claim 14, wherein a maximum angle, α, between the optical axis and an outermost ray of the incident beam passed through the second transmitting portion after passing through the first transmitting portion and reflecting on the first and second reflecting portions, satisfies the following condition in the air

$$\alpha \geq 36^{\circ}.$$

21. The optical pickup of claim 20, wherein at least one of the first and second reflecting portions further comprise a path difference generating portion generating a separate optical path for at least a portion of the incident beam, reducing the side lobe components of the light spot formed through the second transmitting portion by a difference

in paths of a portion of the incident beam on the path difference generating portion and the remainder of the incident beam.

22. The optical pickup of claim 21, wherein the path difference generating portion projects from the concave curvature of the second reflecting portion.

23. The optical pickup of claim 21, wherein the path difference generating portion recesses into the concave curvature of the second reflecting portion.

24. The optical pickup of claim 21, wherein the path difference generating portion is formed in the first reflecting portion.

25. The optical pickup of claim 14, wherein at least one of the first and second reflecting portions further comprise a path difference generating portion generating a separate optical path for at least a portion of the incident beam, reducing the side lobe components of the light spot formed through the second transmitting portion by a difference in paths of a portion of the incident beam on the path difference generating portion and the remainder of the incident beam.

26. The optical pickup of claim 25, wherein the path difference generating portion projects from the concave curvature of the second reflecting portion.

27. The optical pickup of claim 25, wherein the path difference generating portion recesses into the concave curvature of the second reflecting portion.

28. The optical pickup of claim 25, wherein the path difference generating portion is formed in the first reflecting portion.

29. The optical pickup of claim 14, wherein the first transmitting portion has curvature with a negative power.

30. The optical pickup of claim 14, further comprising a detecting-correcting unit, on the optical path between the optical path changing unit and the objective lens, performing at least one of detecting the thickness of the optical disk and correcting aberration caused by thickness variations of the optical disk.

31. The optical pickup of claim 30, wherein the detecting-correcting unit comprises a first lens and a second lens arranged on the optical path, the first lens being closer to the light source than the second lens, wherein the detecting-correcting unit actuates at least one of the first lens and the second lens to perform one of detecting the thickness of the optical disk and correcting aberration caused by thickness variations of the optical disk.

32. An optical pickup, comprising:

a light source emitting an incident beam;

an optical path changing unit altering a traveling path of the incident beam;

an objective lens focusing the incident beam from the light source to form a light spot on the optical disk;

a photodetector receiving the beam reflected from the optical disk and passed through the objective lens and the optical path changing unit; and

a detecting-correcting unit, arranged on the optical path between the optical path changing unit and the objective lens, performing at least one of detecting the thickness of the optical disk and correcting aberration caused by thickness variations of the optical disk.

33. The optical pickup of claim 32, wherein the objective lens is disposed on an optical path between the optical path changing unit and the optical disk.

34. The optical pickup of claim 33, wherein the detecting-correcting unit comprises a first lens and a second lens arranged on the optical path, the first lens being closer to the light source than the second lens, wherein the detecting-correcting unit actuates at least one of the first lens and the second lens to perform one of detecting the

thickness of the optical disk and correcting aberration caused by thickness variations of the optical disk.

35. The optical pickup of claim 32, wherein the objective lens comprises:

a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relatively near-axis region from an optical axis of the objective lens;

a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion;

a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion; and

a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the first transmitting portion.

36. An optical disk, comprising:

an information substrate, wherein the information substrate comprises

an incident surface receiving light to record and reproduce information; and

a recording surface on which an information signal is recorded and from which at least a portion of an incident beam is reflected, wherein the thickness from the incident surface of the information substrate to the recording surface is less than 0.1 mm.

37. The information substrate of claim 36, wherein a thickness error from the incident surface of the information substrate to the recording surface is within $\pm$ 5 μm.

38. An objective lens focusing an incident beam from a light source to form a light spot on an optical disk, comprising:

at least one transmitting portion transmitting the incident beam; and

at least one reflecting portion condensing and reflecting the incident beam from the

at least one transmitting portion.

39. The objective lens of claim 38, wherein the at least one transmitting portion comprises a first transmitting portion and a second transmitting portion, wherein the second transmitting portion is arranged facing the first transmitting portion.

40. The objective lens of claim 39, wherein the at least one reflecting portion comprises a negative power and a first reflecting portion formed around the second transmitting portion.

41. The objective lens of claim 40, wherein the at least one reflecting portion further comprises a positive power and a second reflecting portion formed around the first transmitting portion.

42. An objective lens, comprising:

a single lens configuration comprising a high numerical aperture to form a high-density, high resolution light spot.

43. The objective lens of claim 42, wherein the wherein the numerical aperture comprises at least 0.8.

44. The objective lens of claim 42, wherein the single lens configuration comprises a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relative near-axis region from an optical axis of the objective lens.

45. The objective lens of claim 44, wherein the single lens configuration further comprises a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion.

46. The objective lens of claim 45, wherein the single lens configuration further

comprises a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion.

47. The objective lens of claim 46, wherein the single lens configuration further comprises a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the second transmitting portion.

48. An objective lens, comprising:

a single lens configuration shielding a near-axis beam and comprising a numerical aperture of at least 0.8.

49. The objective lens of claim 48, wherein the single lens configuration comprises a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relative near-axis region from an optical axis of the objective lens.

50. The objective lens of claim 49, wherein the single lens configuration further comprises a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion.

51. The objective lens of claim 50, wherein the single lens configuration further comprises a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion.

52. The objective lens of claim 51, wherein the single lens configuration further comprises a second reflecting portion, comprising a positive power, condensing and

reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the second transmitting portion.

53. An optical pickup, comprising:

an objective lens comprising a single lens configuration comprising a high numerical aperture to form a high-density, high resolution light spot.

54. The optical pickup of claim 53, wherein the numerical aperture comprises at least 0.8.

55. The optical pickup of claim 53, wherein the single lens configuration comprises a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relative near-axis region from an optical axis of the objective lens.

56. The optical pickup of claim 55, wherein the single lens configuration further comprises a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion.

57. The optical pickup of claim 56, wherein the single lens configuration further comprises a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion.

58. The optical pickup of claim 57, wherein the single lens configuration further comprises a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the second transmitting portion.

59. An objective lens, comprising:

a first transmitting portion divergently transmitting an incident beam, wherein the first transmitting portion is at a relatively near-axis region from an optical axis of the objective lens;

a second transmitting portion transmitting the incident beam, wherein the second transmitting portion is arranged facing the first transmitting portion;

a first reflecting portion, comprising a negative power, condensing and reflecting the incident beam from the first transmitting portion, wherein the first reflecting portion is formed around the second transmitting portion; and

a second reflecting portion, comprising a positive power, condensing and reflecting the incident beam from the first reflecting portion towards the second transmitting portion, wherein the second reflecting portion is formed around the first transmitting portion,

wherein the objective lens forms a small light spot to reproduce information from an optical disk when a ratio of an outer diameter of the second transmitting portion to an outer diameter of the incident beam on the first reflecting portion is 0.5 or less or, when the outer diameter of the second transmitting portion and the outer diameter of the incident beam on the first reflecting portion satisfy the following condition

$$0.1 < \frac{\text{diameter of second transmitting portion}}{\text{outer diameter of light incident on first reflecting portion}} < 0.3$$

60. An optical pickup comprising:

an objective lens comprising:

a first transmitting portion divergently transmitting an incident light beam,

at least one portion converging the diverging light beam to a converging light beam, and

a second transmitting portion transmitting only the converging light beam.

61. The optical pickup of claim 60, wherein the second transmitting portion is opposite to the first transmitting portion on the objective lens and an optical axis of the objective lens passes through the first and second transmitting portions.

62. An optical pickup comprising:

an objective lens comprising:

a first transmitting portion transmitting an incident light beam,

at least another portion to alter a path of the incident light beam,

a second transmitting portion shielding the incident light beam of a near-axis region and transmitting the altered light beam from the at least another portion.

63. The optical pickup of claim 62, wherein the second transmitting portion is opposite to the first transmitting portion on the objective lens and an optical axis of the objective lens passes through the first and second transmitting portions.